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ABSTRACT

This booklet, one of a series developed by the Frederick County Board of Education, Frederick, Maryland, provides an instruction module for an individualized or flexible approach to 7th, 8th, and 9th grade science teaching. Subjects and activities in this series of booklets are designed to supplement a basic curriculum or to form a total curriculum, and relate to practical process oriented science instruction rather than theory or module building. Included in each booklet is a student section with an introduction, performance objectives, and science activities which can be performed individually or as a class, and a teacher section containing notes on the science activities, resource lists, and references. This booklet introduces pupils to the study of ocean currents and their effects. The estimated time to complete the activities in this module is two weeks. (SL)

AIDS TO INDIVIDUALIZE THE TEACHING OF SCIENCE

MINI-COURSE UNITS

BOARD OF EDUCATION OF FREDERICK COUNTY

1973

Frederick County Board of Education

Mini Courses for

Life, Earth, and Physical Sciences

Grades 7, 8, and 9

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Frederick, Maryland

1973

FOREWORD

T ontents represented in these modules of instruction, called mini course ; an indication of our sincere desire to provide a more individualize flexible approach to the teaching of science.

Data was accumulated during the school year relative to topics in life, earth, and physical science that were felt to be of greatest benefit to students. The final selection of topics for the development of these courses during the workshop was made from this information.

It is my hope that these short courses will be a vital aid in providing a more interesting and relevant science program for all middle and junior high school students.

Dr. Alfred Thackston, Jr.
Assistant Superintendent for Instruction

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Globe Book Company - Granted us permission to use one laboratory activity
Milliken Publishing Company - Granted us permission to use thirteen activities

OCEAN CURRENTS

Prepared by

John Fradiska

CONTENTS

Estimated Teaching Time

2 weeks

OCEAN CURRENTS

I. GENERAL INTRODUCTION

Perhaps the most famous of all ocean currents is the Gulf Stream. The Gulf Stream flows northward along the east coast of the United States and then curves eastward toward Europe. Until recently, scientists thought of the Gulf Stream as a kind of river in the sea, an unbroken flow of water that moved at a steady rate.

During the 50's and 60's, scientists began to realize that this was a false picture of the Gulf Stream.

What did scientists learn about the Gulf Stream that caused a change in their thinking?

What man caused scientists to change their thinking about the Gulf Stream?

II. INSTRUMENTS USED TO DETECT OCEAN CURRENTS

Introduction:

Currents speed and motion is determined by a variety of instruments. Many kinds of current meters are in use in the study of ocean currents. Other instruments used in measuring speed and direction of currents are drift bottles and the swallow float or swallow pinger.

Objectives:

A. Identify the instruments used to detect ocean currents.

B. Describe the use and operation of the instruments used in the study of ocean currents.

Activities:

1. After completing the reading assignment, Earth Science, 1965, pp. 235-236 or Modern Earth Science, 1965, pp. 493-496, you will be expected to complete Study Sheet IIA on the next page.

2. Make a sketch of the instruments used in the study of ocean currents using transparency - "Tools of Oceanography".

WORK SHEET - IIA

Instruments

1. List the instruments used in determining ocean current speed and direction.

2. Explain the use and operation of the instruments used in determining ocean current speed and direction.

III. ARE OCEAN CURRENTS MAINLY WIND DRIVEN?

Introduction:

The atmosphere and the oceans are in continuous motion. Scientists have been able to trace direct relationships between wind patterns and ocean currents.

Objectives:

A. Identify the factor that is the primary cause of ocean currents.

B. Trace the general pattern of ocean currents and wind patterns on a world map.

Activities:

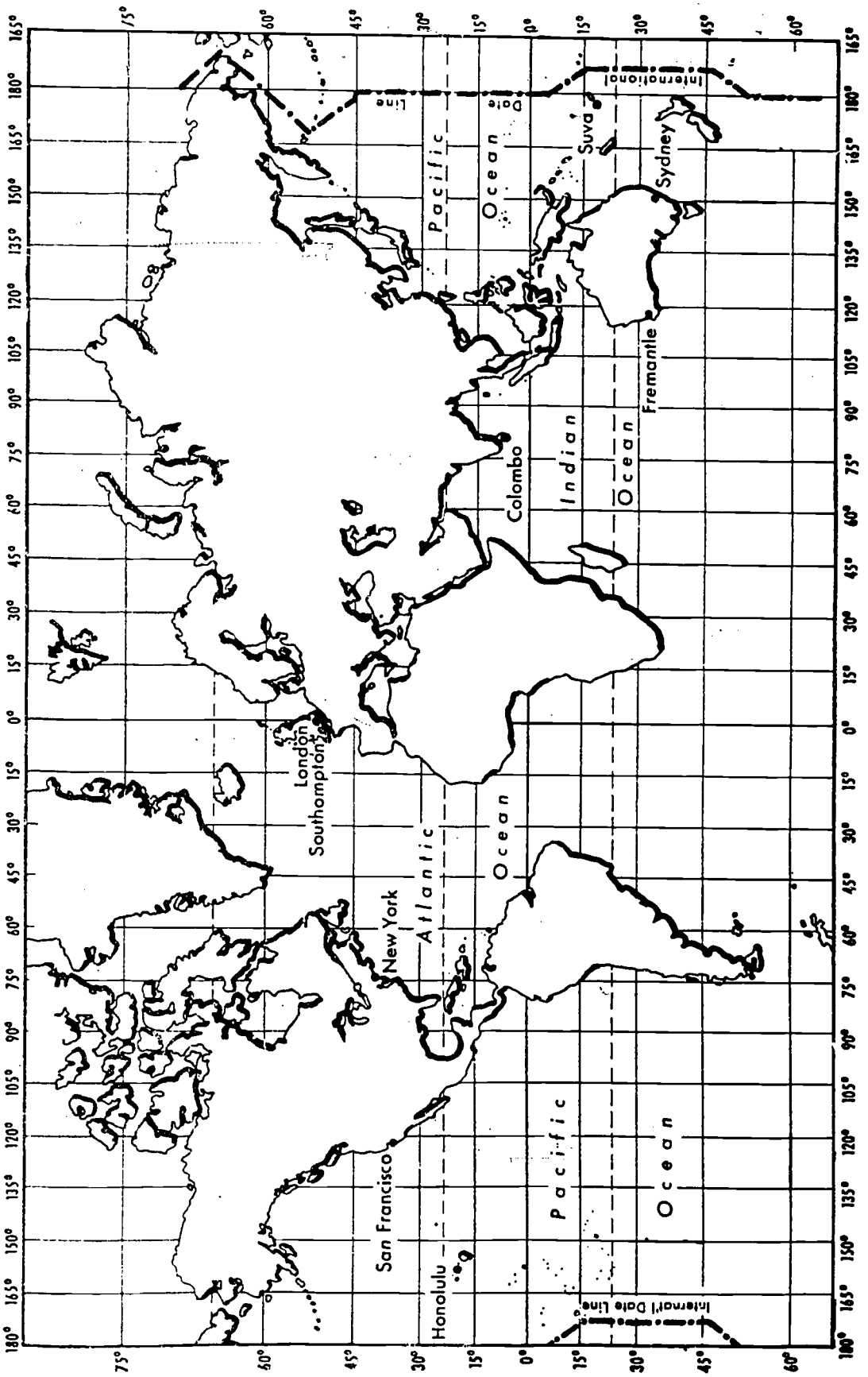
1. Reading assignments
   a. Pathways in Science #2, pp. 144-148
      or
   b. Earth Science, The World We Live In, pp. 254-255, section 7
      (either book could be used to complete the assignment)

2. On a world map, trace the major surface currents in one color and indicate the general direction of wind movement using a different color.

   To complete this assignment, you can use Focus on Earth Science, p. 224, Fig. 12-1 or Pathways 2, p. 148, Fig. 148-1 or Earth Science, p. 256, Fig. 19-5 and a world map is included on the next page

3. Complete Laboratory Problem No. 9: Can Winds Cause Water Currents?, pp. 39-42, Pathways in Science Laboratory Workbook #2. (See your teacher for the necessary materials.)

Name Class Date



Map to be used with Activity Number 2

Name _____ _____ Class _____ Date _____

Laboratory Problem No. 9: Can Winds Cause Water Currents?

Reading Reference:

Read pages 144–148, *Pathways in Science*—Earth Science II.

Materials Needed:

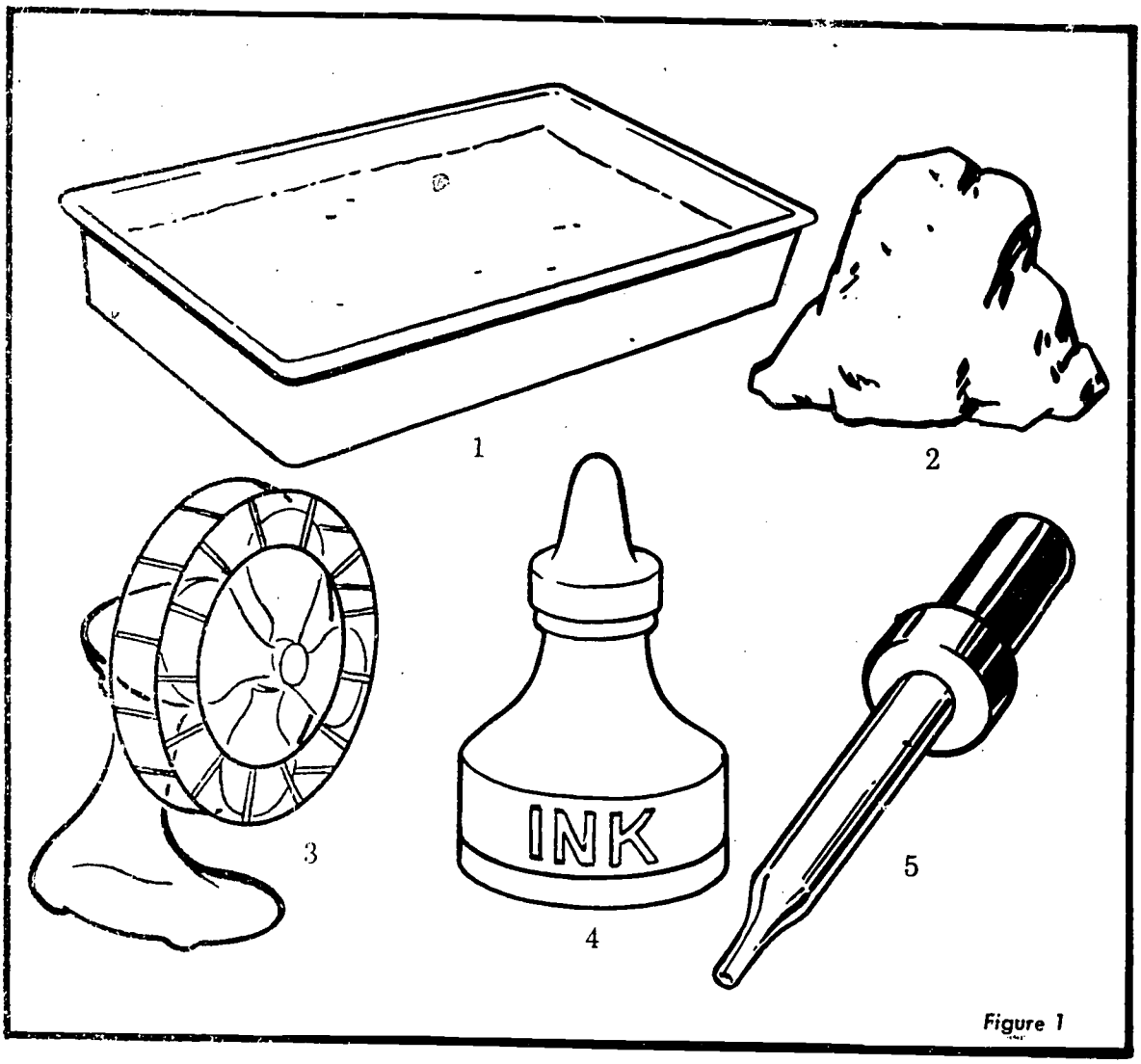


Figure 1

1. large pan of water at least 3 in. deep
2. large rock or lump of modeling clay
3. electric fan
4. washable blue or black ink, or vegetable dye
5. medicine dropper

Procedure:

Step 1—Place the rock in the water somewhere near the center of the pan. The rock represents a large island and the sides of the pan represent continental coastlines.

Step 2—Put one drop of ink in the water and observe what happens to it. Record your observations below, under "What Do We See?"

Step 3—Start the fan after pointing it so that it blows steadily between the rock and one side of the pan. Let it blow for five to ten minutes before proceeding to *Step 4*.

Step 4—With the fan still blowing, put one drop of ink on top of the water along the side of the pan. Stick the medicine dropper down along the side of the pan to the bottom. Squeeze out one drop. Then drop one drop along the side of the rock. Record below what happens to the ink in each case.

What Do We See?

1. Did the first drop of ink move in one direction or did it spread out?

   _____

2. Did the drop on top of the water spread out or flow in one direction?

   _____

   Did it move quickly or slowly?

   _____

3. Describe what happened to the other drops of ink.

   _____

   _____

   _____

What Do We Learn?

1. Was there a current before the fan was turned on? How do you know?

   _____

   _____

   _____

Name _____ Class _____ Date _____

2. Did the wind created by the fan cause a current? Explain.

_____

_____

3. Was the current stronger at the surface or at the bottom?

_____

_____

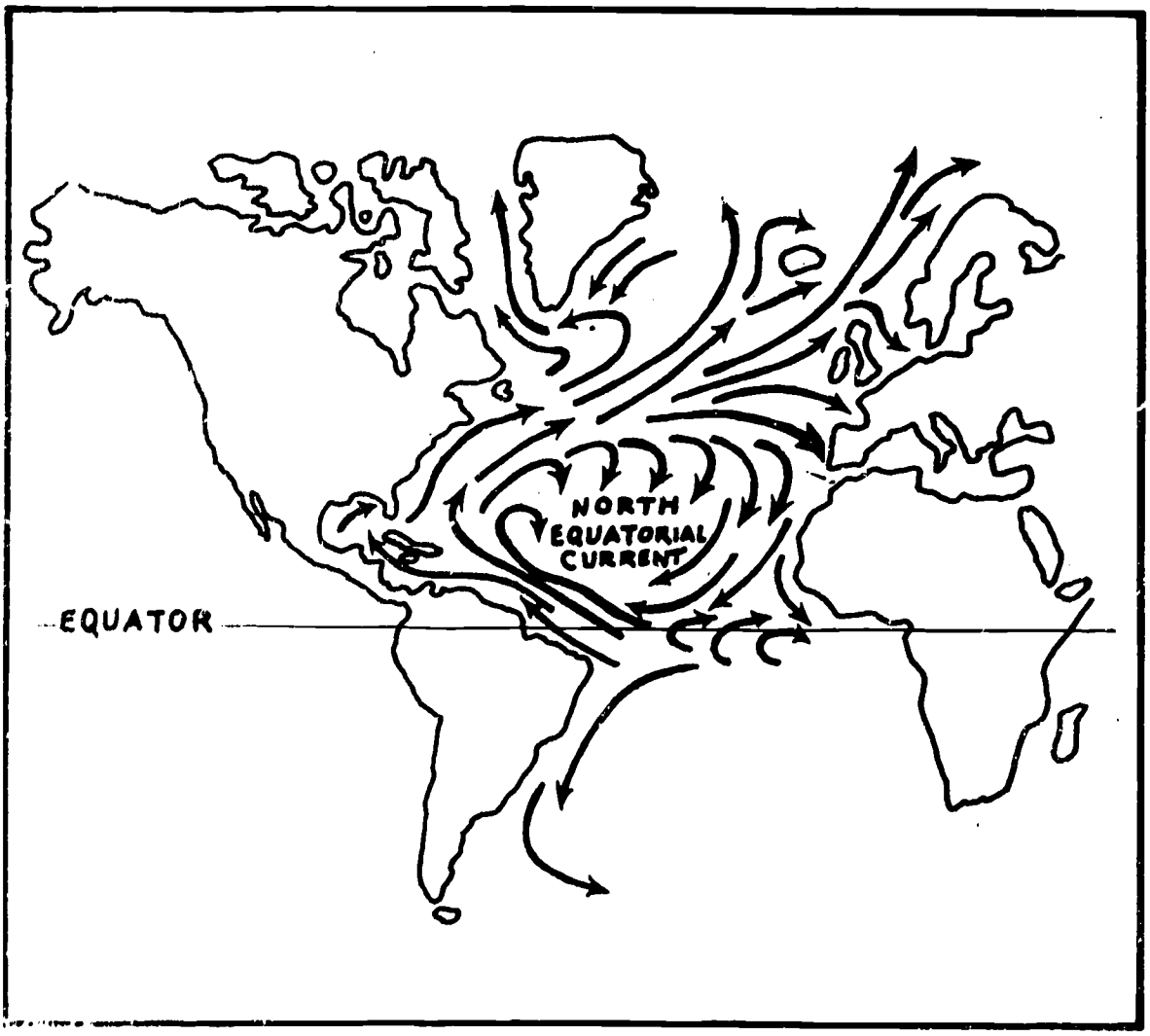
4. Where was the current strongest in the pan?

_____

Where was it weakest?

_____

5. Look at the map of ocean currents in the North Atlantic Ocean; then answer the questions on the following page.



a. In which direction are the prevailing winds?

_____

(*See page 58*, Pathways in Science—*Earth Science II, if you need help.*)

b. What are the prevailing winds in this air called?

_____

c. Do winds cause deep ocean currents?

_____

d. Are there shallow steady currents in the middle of the ocean?

_____

e. India ink is a dye used to indicate the direction of a current. Do you think scientists could use dyes to discover ocean currents?

_____

Things To Do:

1. Repeat the experiment but this time direct the blow of the fan straight across the rock and pan of water rather than along one side.
2. Look at the map on page 148 of *Pathways in Science*—Earth Science II, and see how many major ocean currents are affected by the prevailing winds. (It may be necessary to review Unit II, Chapter 6, "The Blowing Winds," to find the answer.)
3. In the library find materials that reveal the ways in which ocean currents are started.

Find the Word in This Experiment That Means:

1. a steady flow of water in one direction

   _____

2. what waves are started by

   _____

3. the material used to determine the direction and speed of a current

   _____

IV. TYPES OF OCEAN CURRENTS

Introduction:

There are many forces that create currents. Can you name several forces that create currents?

Objectives:

A. Name the major types of ocean currents.

B. Describe the forces that create each type of ocean current.

Activity:

1. After completing the reading assignment in Earth Science, 1965, pp. 251-255 or Modern Earth Science, 1965, pp. 512-516, you will be expected to complete Study Sheet IVA.

INDIVIDUAL STUDY SHEET - IVA

Types of Ocean Currents

1. List the major types of ocean currents.

2. Identify the forces that are involved in creating ocean currents.

3. Give several examples and geographic locations for each of the major types of ocean currents.

V. CAN YOU PRODUCE A TURBIDITY CURRENT?

Introduction:

Turbidity currents can be influenced by conditions in the sea. Turbidity currents can be caused by landslides on the continental slope or by volcanic eruptions within submarine canyons or trenches.

Objective:

A. Conduct an experiment that demonstrates how a turbidity current might occur within the oceans.

Activity:

1. You now will conduct a lab activity. After completing the procedure, you will answer several questions in the results and write a conclusion.

   Title - Producing a Turbidity Current

   Materials - plastic column, clamp, ring stand, soil, sand, salt water

   Procedure - A. Fill a plastic column with salt water about 3/4 full and clamp it at a 45° angle.

   B. Add a solution of soil, sand, and water to the plastic column filled with the salt water.

   Results (Data) A. Does the solution of soil, sand and water mix with the salt water?

   B. Does the solution sink to the bottom of the plastic column?

   C. Describe the motion of the suspended material as it moves down the plastic column.

   Conclusion -

You will now work on a lab activity. After completing the lab activity, you will be expected to write results for part I and II plus a conclusion.

VI. OCEAN CURRENTS - TEMPERATURE AND SALINITY

Objective: To prove that currents are caused by differences in temperature and salinity

Materials: Flasks, glass tubes, hot and cold water, fresh and salt water, rubber stoppers, food coloring, ring stand and clamp

Procedure: I. Put warm water with food coloring in the bottom flask and cold, clear water in the top flask, connect the two flasks by means of the two glass tubes and observe. Record your observations in results Part I.

II. Put water without coloring in the bottom flask and salt water with food coloring in the top flask, connect the two flasks by means of the two glass tubes and observe. Record your observations in results Part II.

The set up for procedure I looks like:

Cold H_2O

Colored water H_2O

The set up for procedure II looks like:

Colored salt H_2O

H_2O

Results: Results Part I

Results Part II

Conclusion:

VII. OCEAN CURRENTS IDENTIFICATION

Introduction:

Currents occur in every major ocean and touch or pass by each continent. Ocean current influence ship travel, weather conditions, and plant and animal life.

Objectives:

A. Identify the major ocean currents on a world map as to name and type.

B. Describe the direction and movement of ocean currents.

Activity:

1. Reading assignments
   a. Study Fig. 6-8, I.E.T., p. 120

   b. Study Fig. 19-5, Earth Science, 1965, p. 256
      or
   c. Study Fig. 148-1, Pathways II, p. 148

2. After studying one of the figures above, you now will complete map activity Lab Sheet VIIA. A map is provided for this activity.

LAB SHEET - VIIA

Title: Ocean Currents

Materials: World map, colored pencils

Procedure: Label the following ocean currents on a world map, showing the cold currents in blue and the warm currents in red:

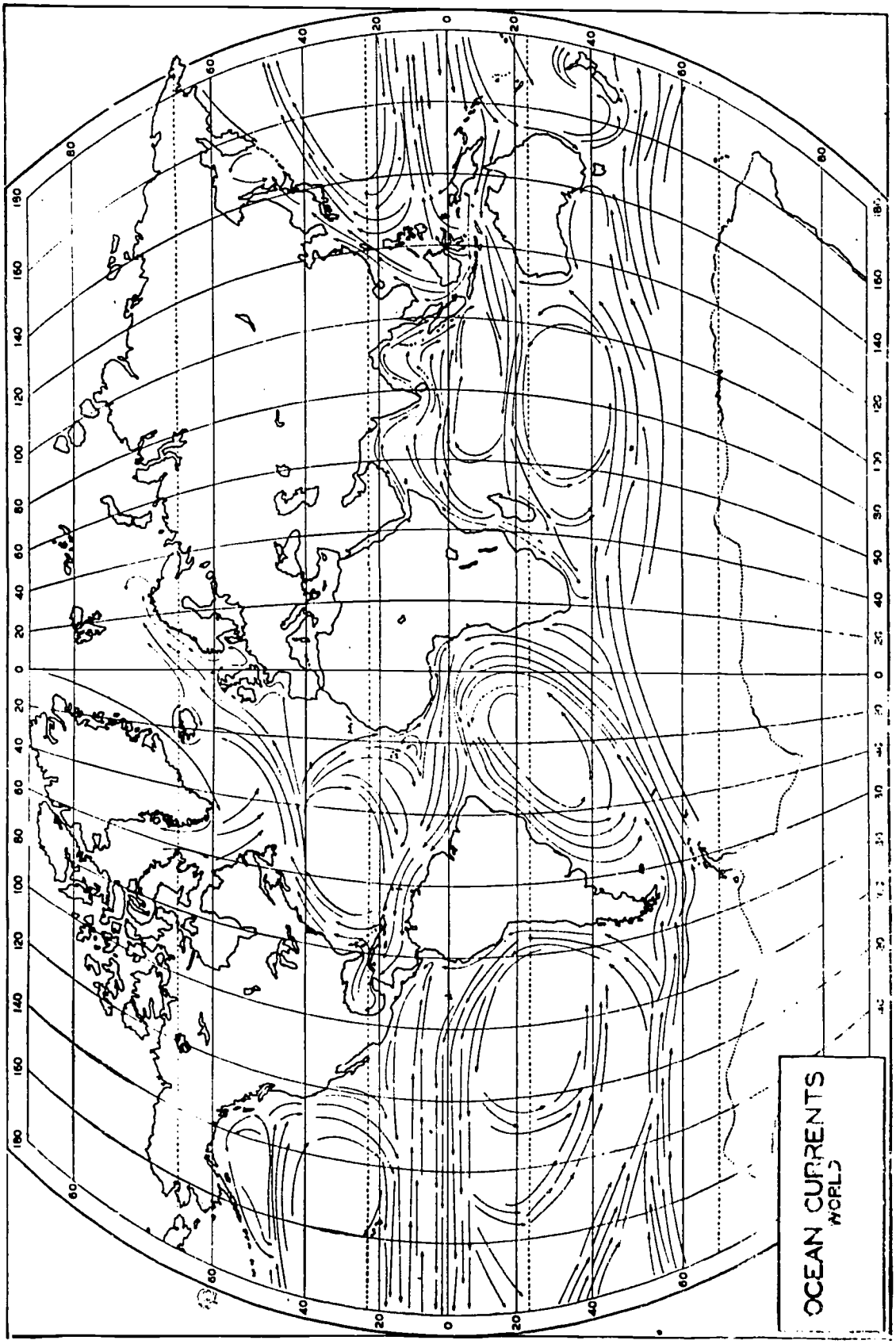
North Equatorial Current
South Equatorial Current
Equatorial Counter Current
Gulf Stream
Labrador Current
North Atlantic Drift
Japan Current
Peru Current
Benguela Current
California Current
Antarctic Current
Alaska Current
West Wind Drift Current
Australian Current

Results: Describe the direction and movement of ocean currents.

Conclusions:

Name_____ Class_____ Date_____

Map to be used with Lab Sheet VIIA



VIII. OCEAN CURRENTS SUMMARY

In summary of this unit, your teacher will show you the filmstrip, Mighty Currents of the Sea or the film, Ocean Currents.

IX. GOING FURTHER

1. Write a report on the Gulf Stream.

2. Read the book Kontiki and write a summary.

3. Read about the Ra Expedition.

4. Contrast and compare ocean currents and climate.

5. Construct a current meter.

6. Describe the effect of the currents around the North Atlantic Ocean on the climate on the surrounding land masses. (Labrador current effect on North America and Gulf Stream effect on coast of England.)

Notes on Activities

I. Answers to the questions in the general introduction: (1) The general movement of the Gulf Stream has many wanderings, [illegible].

II. The transparency necessary to make the sketch is available at the Instructional Materials Center (IMC) in the booklet Oceanography. Milliken Publishing Company.

III. World maps should be duplicated in advance of activity 2. Maps [illegible] necessary to complete activity 3 should be collected and [illegible] the classroom.

IV. To complete this activity, you will need to duplicate copies of [illegible] Sheet IVA.

V. You will need to gather the necessary equipment to produce a turbidity current. For this activity, students could work in groups of 3 or

VI. To complete this activity, the greater the differences in temperature and salinity, the more dramatic the activity.

VII. Ocean Currents Identification - For this mapping activity you [illegible] to duplicate Lab Sheet VIIA.

VIII. To complete this unit, show the class or let groups of students view the filmstrip, Mighty Currents of the Sea, FS500, located at the IMC, or the film, Ocean Currents, F359, located at the IMC or both audio-visuals.

IX. This section can be used in a variety of ways. Several ways are individual research, extra credit, or personal enjoyment.

This unit was designed to be used with the text resources listed here; [illegible] other books do have chapter material which can be used with these activities.

Resources

1. Pathways in Science, Oxenhorn and Idelson, 1968, [illegible]
2. Earth Science-The World We Live In, Namowitz and [illegible]
3. Modern Earth Science, 1965, Ramsey and Burckley, Holt, [illegible]
4. Focus on Earth Science, 2nd edition, Bishop, Lewis, Brobaugh, [illegible] Charles E. Merrill Publishing Co.
5. Interaction of Earth and Time, 1972, Rand McNally [illegible]

Evaluation

It is suggested that the teacher determine the evaluation [illegible] the lab write-up or the completed map could be used as [illegible]

Evaluation Form for Teachers

1. Name of the mini course _____

2. Was this unit appropriate to the level of your students?

3. Explain how this mini course was used with your students. (Individual, small group, or total class)

4. Identify the plus factors for this course.

5. List the changes that you would recommend for improvement.

7. Did you use any other valuable resources in teaching this unit? If so, please list.

PLEASE RETURN TO SCIENCE SUPERVISOR'S OFFICE AS SOON AS YOU COMPLETE THE COURSE.

ADDITIONAL SCIENCE MINI-COURSES

LIFE SCIENCE	Prepared by
A Study for the Birds	Terrence Best
Creepy Critters (Snakes)	Terrence Best
How's Your Plumbing?	Paul Cook
Guess Who's Been Here for Dinner	Paul Cook
Plants - The "Other" Living Things	Sharon Sheffield
Let's Look at You - The Human Organism	Sharon Sheffield
Classification: Why is There a Need?	Melvin Whitfield
Protist: The "Unseen" Kingdom	Melvin Whitfield

EARTH SCIENCE	
Coastline Development	Nelson Ford
Ocean Currents	John Fradiska
Features of the Ocean Floor (Ocean Floor Topography)	John Fradiska
Space and Its Problems	John Geist
Invertebrate Fossils: Clues to the Distant Past	John Geist
An Attempt towards Independent Study in Astronomy	John Geist

PHYSICAL SCIENCE	
Household Chemistry	Ross Foltz
Notions on Motions	Kenneth Howard
Environmental Chemistry	Fred Meyers